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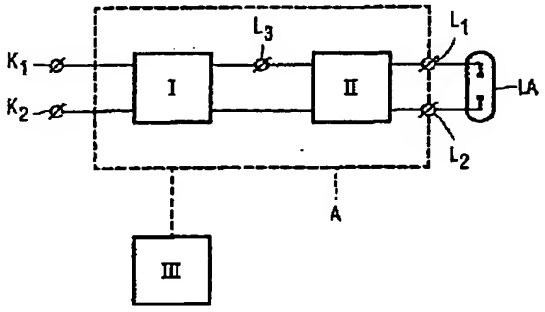
最終頁に続く

(54)【発明の名称】　回路装置

(57)【要約】
本発明は、供給電圧源に接続する入力端子（Ｋ１，Ｋ２）と、前記高圧放電ランプを接続する出力端子と、前記入力端子に結合され、交流ランプ電流を高圧放電ランプに供給する手段とを有する高圧放電ランプを点灯する回路装置に関する。ランプ電流は期間毎に平均値Ｉｍを持つ。本発明によれば、前記ランプ電流が、各期間の開始において、陰極フェーズの電極に対する安定した拡散的アタックを許容するように、前記平均値Ｉｍに対して低くされている。前記回路装置は、とりわけ、光学投影システムにおいてランプを点灯するのに適している。



【発明の詳細な説明】

【０００１】

【技術分野】

本発明は、点灯中に陰極フェーズ(cathodic phase)にある電極を持つ高圧放電ランプを点灯する回路装置であって、

－供給電圧源に接続する入力端子と、

－前記高圧放電ランプを接続する出力端子と、

－前記入力端子に結合され、双極性の連続する期間(periods)を持つ交流ランプ電流を前記高圧放電ランプに供給する手段とを有し、該ランプ電流は期間毎に平均値Ｉｍを持つ回路装置に関する。

【０００２】

【背景技術】

このような回路装置は、米国特許第ＵＳ５６０８２９４号から既知である。既知の回路においては、各期間におけるランプ電流に、各期間の後半部分において電流パルスが重畳されている。高圧放電ランプが交流電流で点灯される場合、ランプの各電極は、ランプ電流の連続する期間中に陰極及び陽極として交互に機能する。それら連続する期間中、ランプ電流を放出する電極は陰極フェーズにある及び他方の電極は陽極フェーズにあると各々言える。ランプを流れる電流の総量が、電流パルスによりランプ電流の各期間の終わりにおいて増加されるため、電極の温度は、放電アークの安定性を増大させるように十分に上昇される。従って、高圧放電ランプのちらつき(flickering)をかなり抑制することができる。自身のちらつきを抑制する特性により、上記回路装置は、とりわけ、投影テレビジョン装置のような投影システムにおいて高圧放電ランプを点灯するのに適している。

【０００３】

既知の回路装置で点灯されたランプは、数百時間の点灯時間にわたってアーク電圧の連続的な上昇を持つことを示した。このような電圧の上昇は、ランプを数千時間実験的に点灯した場合連続して現れた。ランプの寿命にわたりかなり一定であるランプの安定した発光出力は、投影システムにおける使用に極めて重要で

従来技術を越えるような顕著な向上はないことを実験が示した。比ｔ１／ｔｐの上側の値は、妥協(compromise)に依存する。拡散的な安定したアタッチメント(diffuse stable attachment)に対して、上記比はできるだけ長くすべきである。しかしながら、陰極は陰極フェーズ中に冷却する傾向があり、故に、拡散的な安定したアタッチメントで持って放出される電流が低減する傾向があるので、これは要求された出力定格でランプを点灯し続ける必要性とコンフリクトする。故に、実験的に、前記期間の第１部分における増加する電流形状に対して、前記比は好ましくはせいぜい０．５であるべきである、と言うことが示された。ｔ１中減少する電流の状況においては、最大比を０．８５とすることができる。他の点においては、電流Ｉｅ及びＩｍの値に対して、結果として従来技術と比較し電極への余分な負荷の減少をもたらすように、０．３＜＝Ｉｅ／Ｉｍ＜＝０．９を示す、好ましくは、０．６＜＝Ｉｅ／Ｉｍ＜＝０．８を満足する関係を成り立たせるべきである、と言うことが見られた。Ｉｅ＞０．９Ｉｍの電流値に対しては、顕著な効果が見られなかった。ＩｅがＩｍに対して極めて低くなる場合、前記期間の第２部分における平均電流の値Ｉ２は、結果としてランプのちらつきをもたらすような、該期間の第２部分中にアークの不安定が発生する重大な危険性が存するほど高く選択されなければならない。

【０００８】

更に好ましい実施例においては、前記期間の開始における電流がＩｅよりも高い。このようにして、陰極温度が前記期間中に低下し、斯くして、それに従ってアークの安定した拡散的アタッチメント(stable diffuse attachment)が成り立つ電流値が低下する、と言うことが有利にして考慮される。

【０００９】

アークの安定化及びその結果としてランプフリッカの減少が、従来技術から既知のようにランプ電流に付加的な電流パルスを付加することにより更に一層促進される。好ましくは、この場合、前記ランプ電流に、前記期間の終わりにおいて同一極性の、関係Ｉ３＜＝２Ｉｍを満たす値Ｉ３を持つパルスが設けられる。

【００１０】

本発明の上述の及び他の特徴を、図を参照して以下により詳細に説明する。

れる電圧は、ランプ点弧回路において発生される点弧電圧により乱されない直流電圧であるからである。制御手段ＩＩＩは、更に、手段Ｉのスイッチモード電力回路を形成する、少なくともスイッチを有する上記コンバータの誘導手段Ｌを流れる電流を検出するための入力部２、及び導通状態及び非導電状態に周期的にスイッチモード電力回路のスイッチを切り替え、斯くして、前記コンバータの誘導手段Ｌを流れる電流を制御するための出力端子３とを持つ。入力部１は、マイクロコントローラＭＣの接続ピンＰ１に接続されている。マイクロコントローラの接続ピンＰ３は、スイッチング回路ＳＣの入力部４に接続されている。入力部２は、スイッチング回路ＳＣの入力部５に接続されている。スイッチング回路ＳＣの出力部Ｏは、出力端子３に接続されている。

【００１５】

バック即ちダウンコンバータであるコンバータを有する図２に示される回路装置の動作は次の通りである。マイクロプロセッサＭＣには、ランプ電圧、時間の組み合わせにラベルが付されたコンバータのピーク電流値のマトリックスを含むソフトウェアが設けられている。斯様に見出されるコンバータのピーク電流値は、入力部４においてスイッチング回路ＳＣに供給され、そして入力部５においてスイッチング回路ＳＣにも供給される、入力部２において検出された電流に対する比較基準として用いられる。この電流値の比較に基づいて、スイッチング回路は、出力部Ｏにおいてスイッチオフ信号を発生する。これは、検出された電流がピーク電流値に等しい場合にダウンコンバータのスイッチを非導通状態に切り替える。結果として、誘導手段を流れる電流が減少するであろう。コンバータのスイッチは、誘導手段Ｌを流れる電流が零になるまで非導通状態に保持される。コンバータ電流が零になることを検出すると、スイッチング回路ＳＣは、ダウンコンバータのスイッチを導通にするスイッチオン信号を出力部Ｏにおいて発生する。ここで、誘導手段Ｌを流れる電流は、ピーク電流値に到達するまで増加を開始する。そのようなスイッチング回路ＳＣは、例えば、国際特許出願公開第ＷＯ９７／１４２７５号から既知である。ピーク電流の値は、ランプ電圧が制御手段ＩＩにより検出される度毎にリフレッシュされる。

【００１６】

図６は、更に他の好ましい実施例による電流のグラフを示している。この実施例においては、ランプ電流に、当該期間の終わりにおいて同一極性の値Ｉ３を持つパルスが設けられている。上述の実施例を実際に実現するに当たり、Ｉ３の値は、１．６Ｉｍである。

【００２１】

上述の回路装置の実用的な実施例を、フィリップス社製のタイプＵＨＰの高圧放電ランプの点灯用として用いた。このランプは、１００Ｗの公称消費電力を有し、わずか１．３ｍｍの電極距離を持ち、図４による電流で点灯された。電流の値は、Ｉｅ＝０．９３Ａ、Ｉｍ＝１．２５Ａ、Ｉ２＝１．３３Ａである。故に、比Ｉｅ／Ｉｍは０．７４である。期間の継続時間ｔｐは、９０Ｈｚの整流手段ＩＩの動作周波数に応じて５．６ｍｓであり、比ｔ１／ｔｐは０．２である。マイクロプロセッサＭＣとして、フィリップス社製のＰ８７Ｃ７４９ＥＢＰが、各期間中２回ランプ電圧を検出するようにプログラムされる場合に適切であることを示した。図６による電流パルスが各半期間の後半８％の間ランプ電流に重畳され、その結果として１．４×Ｉｍの電流Ｉ３となるような他の実用的な実施例において、ちらつきをかなり抑制することができた。

【００２２】

ランプ電圧は、１００時間のランプライフにおいて８５Ｖであり、５００時間の点灯後９４Ｖへの増加を示した。比較のために、従来技術による回路装置で同一のランプを点灯させた。この場合においては、ランプ電圧が、１００時間における８５Ｖから、わずか３００時間の点灯後１１０Ｖに増加した。

【図面の簡単な説明】

【図１】

本発明による回路装置の概略的な図を示している。

【図２】

図１の本発明による回路装置の実施例の制御手段を示している。

【図３】

図１による装置により提供されるランプ電流のグラフである。

【図４】

【図１】

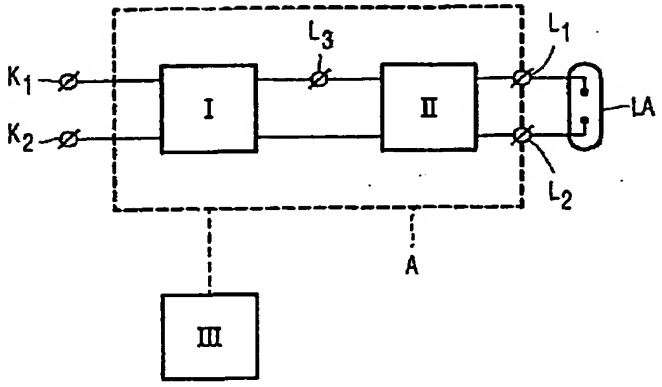


FIG. 1

【図２】

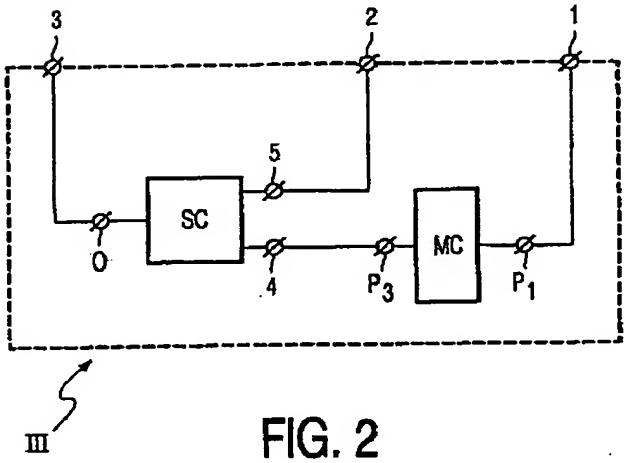


FIG. 2

【図５】

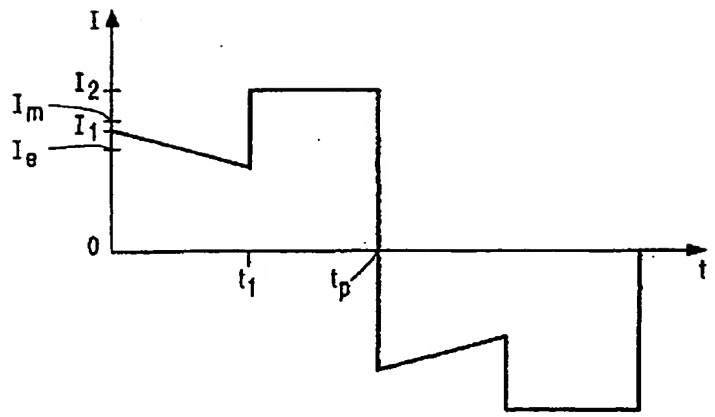


FIG. 5

【図６】

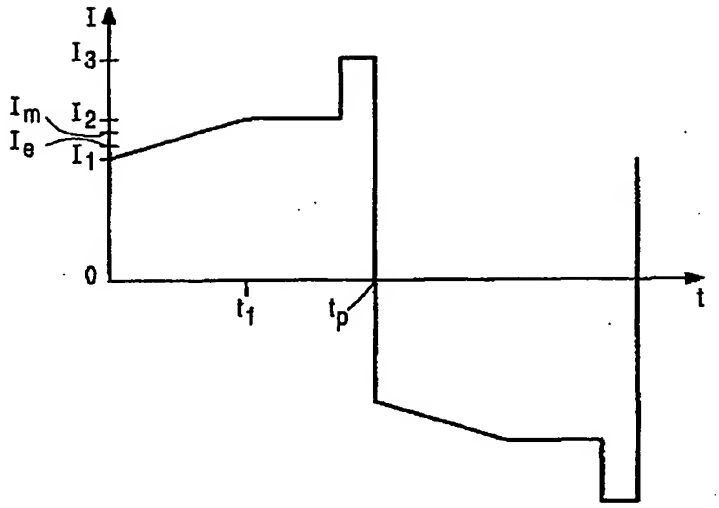


FIG. 6

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/EP 99/09594

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DE 4439885 A	09-05-1996	WO 9614724 A	17-05-1996
		DE 59503289 D	24-09-1998
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Form PCT/ISA/210 (patent family annex) (July 1992)

CIRCUIT ARRANGEMENT

Patent number: WO0036883
Publication date: 2000-06-22
Inventor: DERRA GUNTHER H; FISCHER HANNS E; GANSER HANS G; KRUECKEN THOMAS; MOENCH HOLGER; SNIJKERS ROB
Applicant: KONINKL PHILIPS ELECTRONICS NV (NL); PHILIPS CORP INTELLECTUAL PTY (DE)
Classification:
- international: ***H05B41/292;*** **H05B41/28;** (IPC1-7): H05B41/292
- european: H05B41/292L
Application number: WO1999EP09594 19991202
Priority number(s): EP19980204287 19981217

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Cited documents:
DE4439885
US5608294
DE4410177

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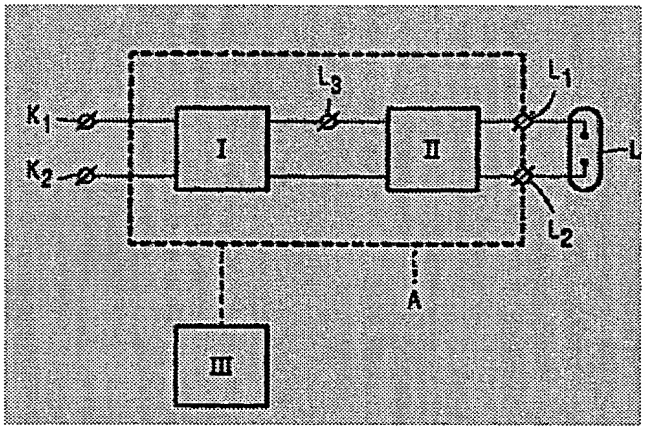
Abstract of **WO0036883**

The invention is concerned with a circuit arrangement for operating a high pressure discharge lamp comprising input terminals (K1, K2) for connection to a supply voltage source, output terminals for connecting the high pressure discharge lamp, and means, coupled to the input terminals, for supplying an alternating lamp current to the high pressure discharge lamp. The lamp current has per period a mean value Im. According to the invention the lamp current in each period at its start is lowered with respect to the mean value Im so as to allow for stable diffuse attachment on the cathodic phase electrode. The circuit arrangement is in particular suited for operating a lamp in an optical projection system.



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CLAIMS

[Claim(s)]
[Claim 1] The input terminal which is the circuit apparatus which turns on the high-pressure discharge lamp which has an electrode in a cathode phase during lighting, and is connected to the source of - supply voltage, - It is combined with the output terminal which connects said high-pressure discharge lamp, and the - aforementioned input terminal. Having a means to supply an alternating current lamp current with the period when a bipolar continues to said high-pressure discharge lamp, this lamp current is a circuit apparatus which has the average Im for every period. Said lamp current sets to initiation of each period. The circuit apparatus characterized by the low thing to said average Im so that the stable diffusion-attack to the electrode of a cathode phase may be permitted.
[Claim 2] The circuit apparatus according to claim 1 characterized by said lamp current having the average Im for every period, covering a part for part I of this period, having the lower average Ie, covering a part for part II of this period, and having the larger average current I2 than Im.
[Claim 3] It is the circuit apparatus according to claim 1 or 2 characterized by for said period having Duration tp and the amount of [of this period] said part I having the duration t1 with which the relation of 0.05 <=t1/tp<=0.85 is filled.
[Claim 4] The circuit apparatus according to claim 1, 2, or 3 characterized by being 0.3 <=Ie/Im<=0.9.
[Claim 5] The circuit apparatus according to claim 2, 3, or 4 with which the current in initiation of said period is characterized by being higher than Ie.
[Claim 6] A circuit apparatus given in claim 1 characterized by establishing the pulse which has the value I3 with which the same polar relation I3 <=2Im is filled in the end of said period in said lamp current thru/or any 1 term of 5.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]
the input terminal which this invention is a circuit apparatus which turns on the high-pressure discharge lamp which has an electrode in a cathode phase (cathodic phase) during lighting, and is connected to the source of - supply voltage, and - the output terminal which connects said high-pressure discharge lamp, and - it is combined with said input terminal, it has a means supply an alternating current lamp current with the period (periods) when a bipolar continues to said high-pressure discharge lamp, and this lamp current is related with the circuit apparatus which has the average Im for every period.
[0002]
[Background of the Invention]
such a circuit apparatus -- the [United States patent] -- it is known from US No. 5608294. In the known circuit, the lamp current in each period is overlapped on the current pulse in the second half part of each period. When a high-pressure discharge lamp is turned on by alternating current, each electrode of a lamp functions by turns as cathode and an anode plate during the period when a lamp current continues. During the period which they-continues, and the electrode which emits a lamp current is in a cathode phase, it can be said respectively that the electrode of another side is in an anode plate phase. Since the total amount of the current which flows a lamp is increased by the current pulse in the end of each period of a lamp current, the temperature of an electrode fully rises so that the stability of a discharge arc may be increased. Therefore, a flicker (flickering) of a high-pressure discharge lamp can be controlled considerably. It is suitable for dividing the above-mentioned circuit apparatus and turning on a high-pressure discharge lamp in a projection system like a projection TV apparatus with the property which controls a flicker of self.
[0003]
It was shown that the lamp turned on with the known circuit apparatus has the continuous rise of arc voltage over hundreds of hours lighting time amount. The rise of such an electrical potential difference appeared continuously, when a lamp was turned on experimentally for thousands hours. Since the radiant power output by which the quite fixed lamp was stabilized over the life of a lamp is very important for the use in a projection system, the rise of continuous arc voltage serves as a serious disadvantageous point for reaching a long lamp life.
[0004]
[Description of the Invention]
the purpose of this invention -- the above -- it is in offering the circuit apparatus which turns on the high-pressure discharge lamp with which a disadvantageous point is offset.
[0005]
According to this invention, the circuit apparatus stated to the beginning paragraph is characterized by the low thing to said average Im so that said lamp current may permit the stable diffusion-attack to the electrode of a cathode phase in initiation of each period for this purpose. The equipment concerned has

the advantage referred to as making it possible to flicker over a long period of time and to make a lamp turn on that there is nothing while a discharge arc has a soft start (soft start) in each period by attaching two electrodes in diffusion during lamp lighting, consequently it brings about a lower electrode load, therefore reduces generating of a rise of arc voltage very remarkably.
[0006]
The average Im of the current over the period concerned corresponds to the power Pla of the lamp according to related Pla=ImxVla with lamp voltage Vla. Preferably, the average Ie of the current covering a part for part I of the period concerned was smaller than the value Im, and the experiment showed covering a part for part II of this period, and saying that the average current value I2 is larger than Im. This brings about the attachment of the arc which raised the soft current start in the beginning of each period with the attachment of the diffusion-arc covering a part for part I of said period, consequently was stabilized further. As a result of the current I2 covering a part for part II of said bigger period than Im, the need for the additional current pulse near the end of this period is reduced further.
[0007]
In the desirable example of the equipment by this invention, said period has Duration tp and the amount of [of this period] said part I has the duration t1 with which the relation of 0.05<=t1/tp<=0.85 is filled. When the value of Ratios t1/tp was smaller than 0.05, the experiment showed that there was no remarkable improvement which exceeds the conventional technique. It depends for the value of Ratio t1/tp top on compromise (compromise). The above-mentioned ratio should be made as long as possible to the stable diffusion attachment (diffuse stable attachment). However, since cathode has the inclination which the current which tends to cool during a cathode phase, therefore is emitted by having by the stable diffusion attachment reduces, this carries out a conflict to the need of continuing turning on a lamp by the demanded output rating. Therefore, saying that said ratio should be at most 0.5 preferably was experimentally shown to the increasing current configuration in a part for part I of said period. The maximum ratio can be set to 0.85 in the situation of the current which decreases among t1. In other points, to the value of Currents Ie and Im, saying that the relation which shows 0.3<=Ie/Im<=0.9 and with which it is satisfied of 0.6<=Ie/Im<=0.8 preferably should be materialized was seen so that reduction of the excessive load to an electrode might be brought about as a result as compared with the conventional technique. Remarkable effectiveness was not seen to the current value of Ie>0.9Im. When Ie becomes very low to Im, the value I2 of the average current in a part for part II of said period must be chosen so highly that the serious danger that the instability of an arc will occur consists in the part II part of this period that brings about a flicker of a lamp as a result.
[0008]
Furthermore, in a desirable example, the current in initiation of said period is higher than Ie. Thus, cathode temperature falls during said period, thus, saying that the current value of which the diffusion-attachment (stable diffuse attachment) by which the arc was stabilized according to it consists falls makes it advantageous, and it is taken into consideration.
[0009]
Reduction in a lamp flicker is promoted further further as stabilization of an arc, and its result by adding an additional current pulse to a lamp current like known from the conventional technique. The pulse which has preferably the value I3 with which the same polar relation I3<=2Im is filled in the end of said period in said lamp current in this case is established.
[0010]
The description of above-mentioned [of this invention] and others is explained to a detail by the following with reference to drawing.
[0011]
[Best Mode of Carrying Out the Invention]
In drawing 1 , I is a means with the input terminals K1 and K2 linked to the source of supply voltage which supplies supply voltage to generate the controlled direct-current supply current. The output terminal of Means I is connected to the input terminal of Commutator II, respectively. The output terminals L1 and L2 which connect a high-pressure discharge lamp La to Commutator II are formed. III

is a control means which controls the value of the current supplied to a lamp by controlling Means I. Means I and Means II are combined with said input terminal, a means to supply an alternating current lamp current with the period when a bipolar continues is built, and this lamp current has the average Im for every period.
[0012]
The actuation of the circuit apparatus shown in drawing 1 is as follows.
[0013]
If input terminals K1 and K2 are connected to the source of supply voltage, Means I will generate direct-current supply current from the supply voltage supplied by the source of supply voltage. Commutator II is changed into alternating current with the period when a bipolar continues this direct current. It is formed in Mr. ** and the value of the current supplied to Lamp La is controlled by the control means III so that the stable diffusion-attack (stable diffuse attack) to the electrode of a cathode phase may be permitted and a lamp current becomes low to the average Im in initiation of each period. In actually realizing the above-mentioned example, Means I is formed of the rectification bridge which a switch mode power circuit, for example, the back, i.e., a down converter, follows. Commutator II has all bridge circuits preferably. Moreover, a lamp gate circuit is preferably incorporated in the rectification means II.

[0014]
In drawing 2 , the control means III which controls a control means I is shown more in the detail. A control means III has the input section 1 for detecting the electrical potential difference between the terminal L1 connected to the lamp, and L2 which forms the signal which shows arc voltage, for example, the arc voltage further called lamp voltage. Preferably, the signal showing lamp voltage is formed by detecting the electrical potential difference in a node L3. It says because the electrical potential difference detected by Mr. ** is direct current voltage which is not disturbed by the striking voltage of arc generated in a lamp gate circuit. A control means III changes the switch of a switch mode power circuit to the input section 2, the switch-on, and the non-conductive state for detecting the current which flows further the guiding means L of the above-mentioned converter which forms the switch mode power circuit of Means I, and which has a switch at least periodically, and has the output terminal 3 for controlling thus the current which flows the guiding means L of said converter. The input section 1 is connected to the contact pin P1 of Microcontroller MC. The contact pin P3 of a microcontroller is connected to the input section 4 of switching circuit SC. The input section 2 is connected to the input section 5 of switching circuit SC. The output section O of switching circuit SC is connected to the output terminal 3.
[0015]
The actuation of the circuit apparatus shown in drawing 2 which has the converter which is the back, i.e., a down converter, is as follows. Software including the matrix of lamp voltage and the peak current value of the converter by which the label was given to the combination of time amount is formed in Microprocessor MC. The peak current value of the converter found out by Mr. ** is supplied to switching circuit SC in the input section 4, and is used as comparison criteria to the current detected in the input section 2 supplied also to switching circuit SC in the input section 5. Based on the comparison of this current value, a switching circuit generates a switch off signal in the output section O. This changes the switch of a down converter to non-switch-on, when the detected current is equal to a peak current value. The current which flows a guiding means will decrease as a result. The switch of a converter is held at non-switch-on until the current which flows a guiding means L becomes zero. If it detects that a converter current becomes zero, switching circuit SC will generate the switch-on signal which carries out the switch of a down converter to a flow in the output section O. Here, the current which flows a guiding means L starts an increment until it reaches a peak current value. such a switching circuit SC -- the [for example, / international patent application public presentation] -- it is known from WO 97/No. 14275. The value of the peak current is refreshed every, whenever lamp voltage is detected by the control means III.
[0016]

Detection of lamp voltage is made as it is also at the repetition rate in each period depending on the configuration of the current which should be realized through a lamp (repetition rate), and it is controlled by the built-in timer of Microcontroller MC. Acquiring lamp voltage as a lamp parameter for detection has the advantage of making it possible to make watt control (wattage control) of a lamp including in the software of a microcontroller originally. Probably, watt control needs the additional control procedure not only in additional detection of lamp voltage but a microcontroller, when the lamp current itself is acquired as a parameter for detection. A down converter operates on the frequency of the range of 45kHz - 75kHz in a desirable example.

[0017]

The lamp current as a result which is formed in actually realizing the above-mentioned example of the circuit apparatus by this invention is shown in the graph of drawing 3 R> 3 about two continuous periods which has a bipolar. The current is set up in accordance with the axis of ordinate in the relative scale. Time amount is shown in accordance with the axis of abscissa. To the 1st period B of Duration tp, a lamp current is crossed to a part for part I of the period concerned which has the average Im and has duration t1, has the lower average Ie, is crossed to a part for part II of the period concerned, and has constant current I2 with the larger average than Im. The value I1 of the current in initiation of said period permits the attachment (diffuse stable arc attachment) of the stable diffusion arc, therefore the thermionic emission of the electrode (emitting electrode) which is emitting the lamp. an above-mentioned example -- setting -- a ratio -- Ie/Im has a value 0.9 and Ratios t1/tp have a value 0.5.

[0018]

Drawing 4 shows the lamp current of other examples. In this example, the current covering a part for part I of the period concerned is uniformly held with the value which permits thermionic emission in initiation of this period.

[0019]

The current as a result depended on other desirable examples is shown in drawing 5 . In this case, the current I1 in initiation of the period concerned is higher than Ie.

[0020]

Drawing 6 shows the graph of the current by other desirable examples further. In this example, the pulse which has the same polar value I3 in a lamp current in the end of the period concerned is established. In actually realizing an above-mentioned example, the value of I3 is 1.6Im.

[0021]

The practical example of an above-mentioned circuit apparatus was used as an object for lighting of a Philips type UHP high-pressure discharge lamp. This lamp has the nominal power consumption of 100W, had the electrode distance of only 1.3mm, and was turned on with the current by drawing 4 . The values of a current are Ie=0.93A, Im=1.25A, and I2=1.33A. therefore, a ratio -- Ie/Im is 0.74. The duration tp of a period is 5.6ms according to the clock frequency of the 90Hz rectification means II, and tp(s) are ratios t1/0.2. The suitable thing was shown when Philips P87C749EBP was programmed as a microprocessor MC to detect lamp voltage twice in each period. The lamp current between 8% was overlapped on the current pulse by drawing 6 in the second half of each ******, and a flicker was able to be considerably controlled in other practical examples which serve as the current I3 of 1.4xIm as the result.

[0022]

Lamp voltage is 85V in the lamp life of 100 hours, and showed the increment to 94V after lighting of 500 hours. The same lamp was made to turn on with the circuit apparatus by the conventional technique for a comparison. In this case, lamp voltage increased to 110V after lighting of 85V in 100 hours to only 300 hours.

[Brief Description of the Drawings]

[Drawing 1]

Rough drawing of the circuit apparatus by this invention is shown.

[Drawing 2]

The control means of the example of the circuit apparatus by this invention of drawing 1 is shown.

[Drawing 3]
It is the graph of the lamp current offered by the equipment by drawing 1 .
[Drawing 4]
It is the graph of the lamp current by the desirable example of said circuit apparatus.
[Drawing 5]
It is the graph of the lamp current by other desirable examples of said circuit apparatus.
[Drawing 6]
It is the graph of the lamp current by other desirable examples of said circuit apparatus further.
[Description of Notations]
K1 -- input terminal K2 -- means II-- commutator III-- which generates input terminal I-- direct-current supply current -- control means La-- high-pressure discharge lamp L1 -- terminal L2 -- terminal L3 -- node SC-- switching circuit MC-- microcontroller 1 -- input section 2 -- input section 3 -- output terminal 4 -- input section 5 -- input section P1 -- the contact pin P3 -- contact pin O-- output section

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[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

[Drawing 1]

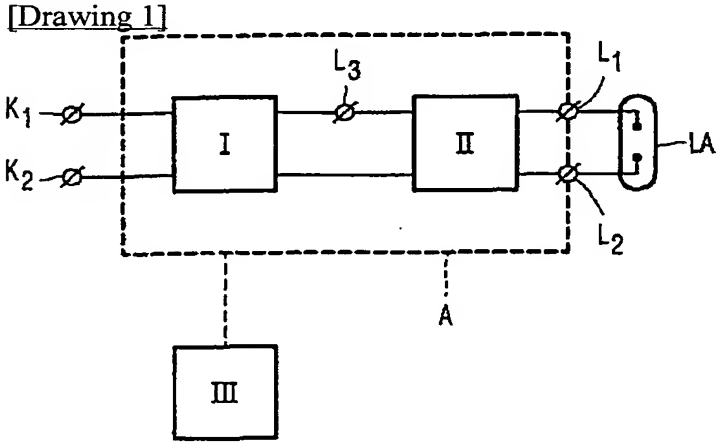

FIG. 1

[Drawing 2]

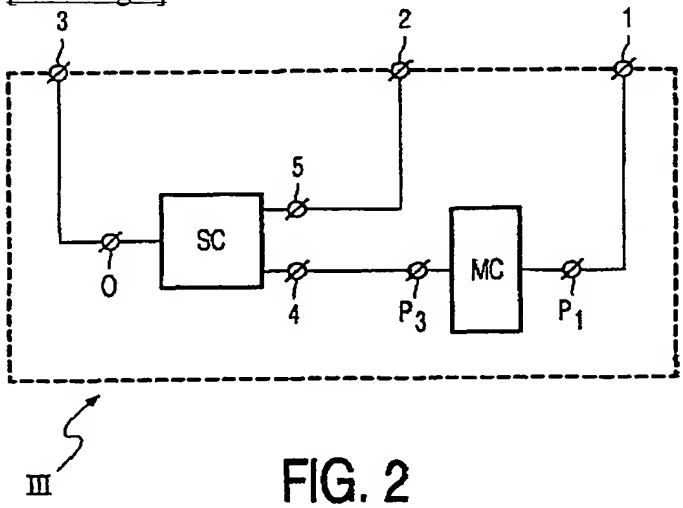

FIG. 2

[Drawing 3]

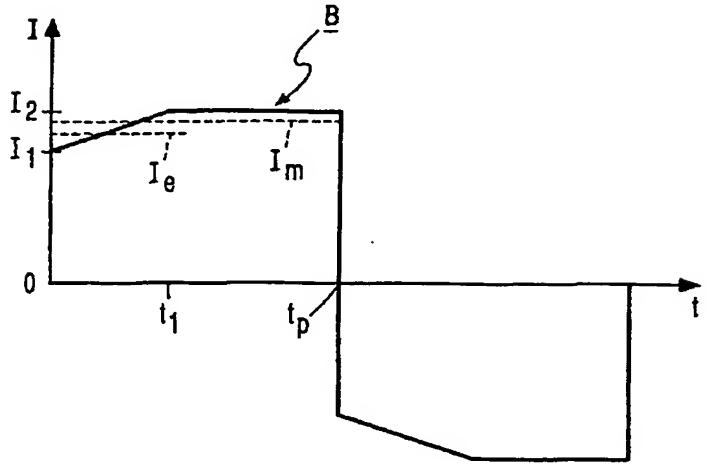

FIG. 3

[Drawing 4]

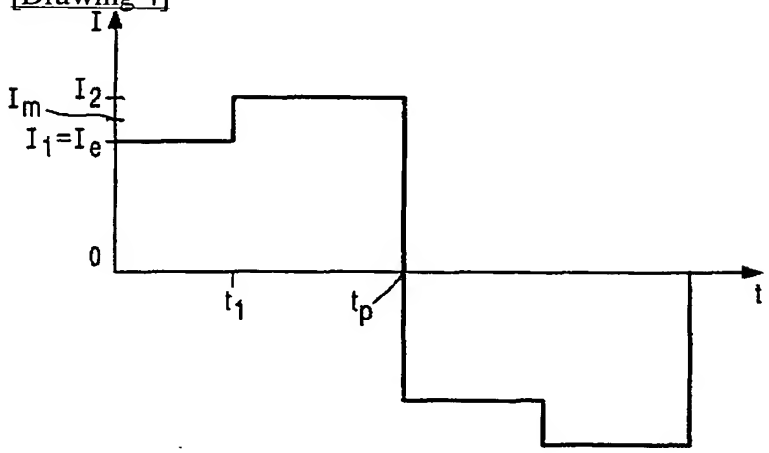

FIG. 4

[Drawing 5]

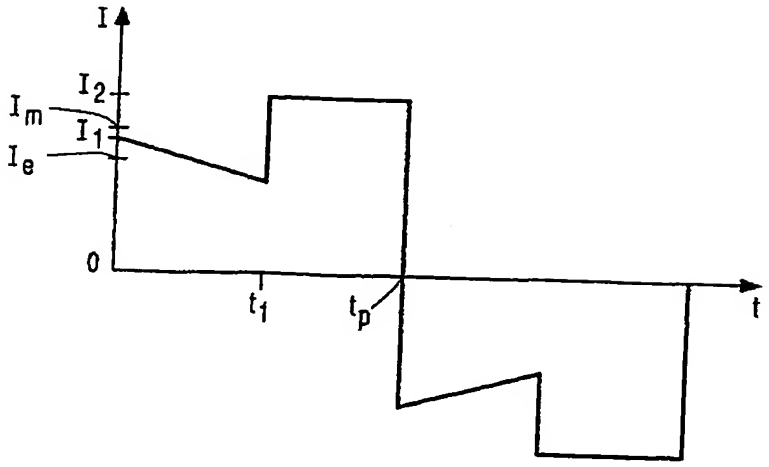

FIG. 5

[Drawing 6]

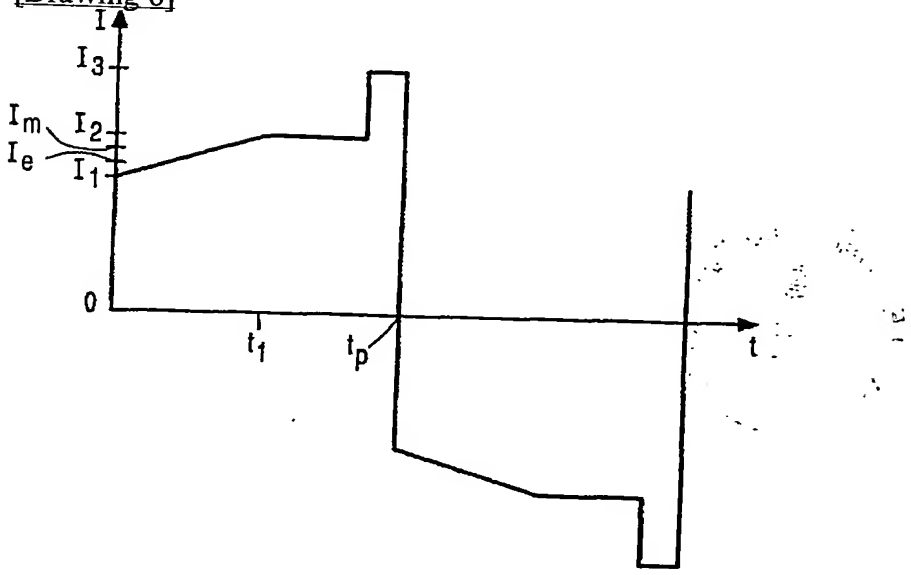

FIG. 6

[Translation done.]